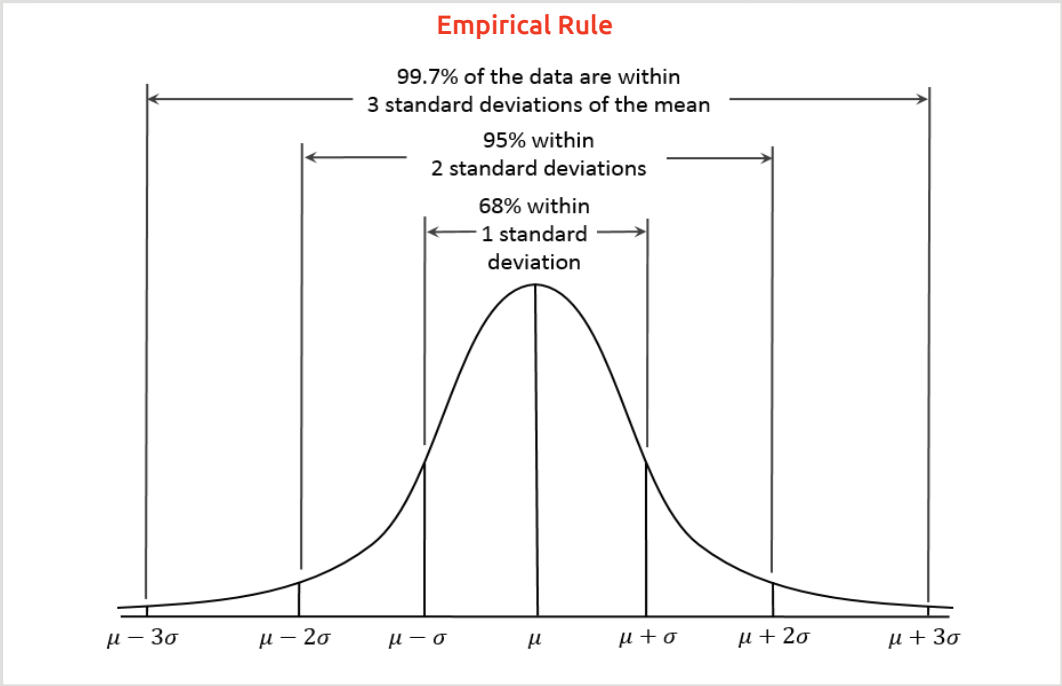
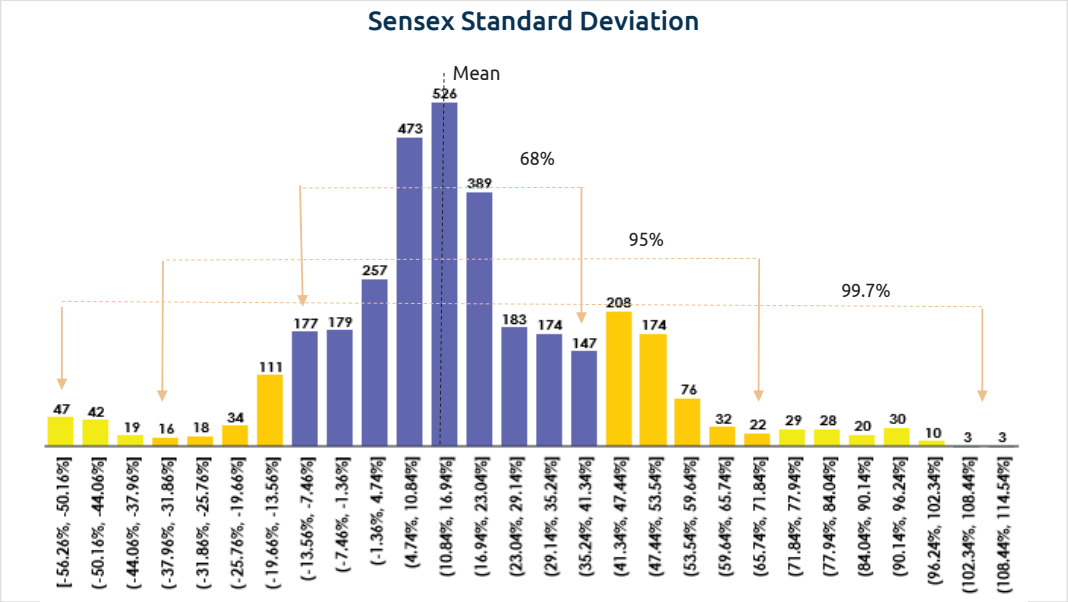
reWISE

Standard Deviation



- Risk assessment is one of the most important aspect of financial management. Standard deviation is a commonly used risk measures.
- Standard deviation measures the dispersion or volatility of the data set or returns from its average or mean. Investors should expect a higher return on an investment. when that investment carries a higher level of risk or uncertainty.
- The fundamental concept of risk is that as it increases, the expected return on an investment should increase as well, the increase in return is known as the risk premium.
- When evaluating investments, investors should estimate both the expected return and the uncertainty of future returns. Standard deviation provides an estimate of the uncertainty of future returns.
- To explain standard deviation in detail, we need to first look at the “Normal Distribution Curve”. A normal distribution or a bell curve occurs naturally when plotting large amount of data, this is an empirical rule.
- The empirical rule tells you what percentage of your data falls within a certain number of standard deviations from the mean. Given below is an illustration to explain the same:
    - 68 of the data falls within one standard deviation of the mean i.e returns are between +34% and -34%.
    - 95% of the data falls within two standard deviations of the mean i.e returns are between +47.7 and -47.7%.
    - 99.7% of the data falls within three standard deviations of the mean i.e returns are between +49.9% and -49.9%.





Source: MFI. The Sensex 1 year rolling return. Data from Jan 2005 to October 2020.Internal research.

- The Sensex returns also follow this rule. In the return distribution histogram for Sensex above, we have taken Sensex 1 year rolling returns from January 2005 to November 2020.

- The mean or the average for the same is 15.86% shown by the black dotted line. The X axis is the rolling returns, while other is the returns data points in that range. The standard deviation is 25.43%.

- We will calculate -
    - One standard deviation μ + or - σ i.e. 15.85% - 25.43% & 15.85% + 25.43%
    - Two standard deviation μ or - 2 σ i.e. 15.85% - (2* 25.43%) & 15.85% + (2*25.43%)
    - Three standard deviation μ or - 3 σ i.e. 15.85% - (3* 25.43%) & 15.85% + (3*25.43%)

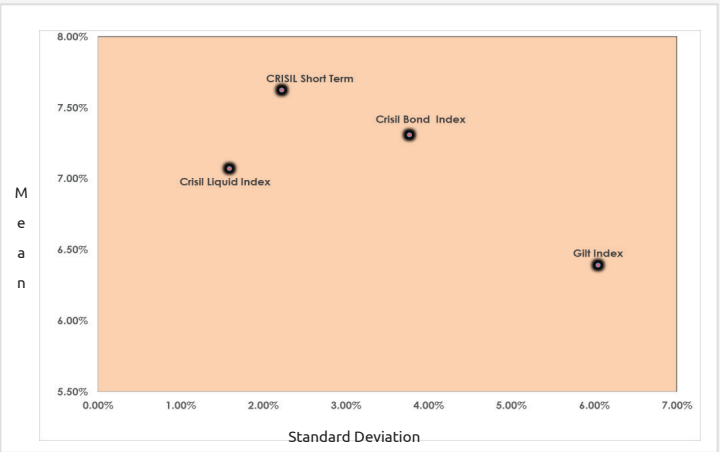
- Observing the above histogram approximately 68 of the returns falls within the range of -9.57% & 41% one standard deviation of the mean. 95% of the returns falls within the range of -35% & 67% two standard deviation of the mean.

- The table below shows the various risk measure for gold and equity indices, for the last 15.8 years. The table concludes that, as the asset becomes more risky, the standard deviation of the assets increase.

Measures	Golds Comdty	Sensex	BSE 200	S&P midcap	S&P BSE Small Cap
Stdev	17.20%	25.43%	26.64%	35.74%	48.20%
Median	11.95%	13.48%	12.06%	12.34%	8.23%
Mean	14.12%	15.86%	15.80%	18.02%	21.16%
Min	-20.57%	-56.26%	-59.81%	-68.48%	-73.24%
Max	75.19%	110.38%	124.07%	163.74%	197.58%

Source: MFI, AMFI, Internal research. 1 year rolling since Jan 05 - Oct '20.

Risk Return Matrix





Source: MFI, AMFI, Bloomberg. For Gold, "Golds commodity index" is used. Standard deviation and mean calculated on 1 year rolling return from Jan'05-30 th Oct '20.

- The graphs shows the risk return relationship for different indices.

- We can clearly conclude from the equity risk return graph, as we move from gold index to small cap index, the risk keeps on increasing so does the returns.

- The risk return co relation is quite obvious for the equity indices However, same is not true in case of the debt indices.

- The table below indicates the variation between different debt indices. A lower standard deviation means data points or returns tend to be closer to mean of its set, which we can say is the returns expectation. While, higher standard deviation indicates the data set or the returns are spread over a wider range.

Measures	Crisil Liquid Index	Crisil Short Term Index	Crisil Bond Index	Gilt Index
Stdev	1.59%	2.22%	3.77%	6.05%
Median	7.38%	8.22%	6.94%	6.11%
Mean	7.07%	7.63%	7.31%	6.39%
Min	3.07%	2.66%	-0.61%	-9.98%
Max	10.24%	11.82%	15.80%	28.76%

Source:MFI, AMFI, Internal research. 1 year rolling since Jan 05 - Oct '20.

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